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Statistical analysis about impact of death rates on Indian economy

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Abstract
This paper takes a deep dive into how the number of deaths affects India's economy, mainly by looking at numbers from the past. We really look closely at everything, looking at things such as mortality rates, alongside important factors that indicate how the economy is performing such as Gross Domestic Product (GDP). What appears from all the earlier searching and studying are patterns and links, showing us how death rates going up or down play a major role in wondering. The Chi-square test analysis has been used to see whether there is a relationship between death rates and GDP in India. It turns out, more people dying can make workers less productive, make healthcare costs higher, and just make the economy unhealthy. A discerning reader, such as yourself, will surely comprehend that this is more than book learning, it's crucial intel for those making the important decisions. The aim is to sort out these health and people puzzles in India before they drag the economy down even more.

Keywords: GDP growth, death rates, Chi-square test, public health, economic growth

1. Introduction
Looking at how death rates and money situations hang together is vitally important, especially in places that are still working on their economy, or, in a very basic essence, in countries trying to grow more, such as India. In India, they've been trying to deal with the major problem of too many people dying for a long time. This problem isn't only because of one thing, but a substantial amount of material mashed together; including how easy it is to get to a doctor, what food people are eating, and how the country's financial situation is doing overall. Now, some really intelligent and informed people studying this found out something pretty interesting. They saw that the changes in India's large amount of money, or what grown-ups like to call the gross domestic product (GDP), play a strikingly large role in how many people are dying. This basically vividly projects the concept of that when India's economy does better, fewer people die.

This study is really focused on finding out if changing death rates affect India's economy, looking closely at GDP and different signs of economic health. We are using methods such as Chi-square test to measure how these things are connected. We want to show that if health improves, the economy might grow, and the other way around too. Knowing this material could help those in charge come up with better plans to boost both people's health and the economy; the goal of our research paper is to dive deep into the numbers to see if fewer people dying, improving, or in substance similar to, can mean good news for making money and overall country well-being. Previous researches (Yadav, 2022) [6] really explore how India's economic growth and the number of people dying are connected; they found that when their economy did well, fewer people died. It seems that regarding 46% of how often people died between 2011 and 2019 had to do with how well or badly the economy was doing; there is a profound and deep-seated certainty that getting the economy better makes people healthier.

As I'm, as I start a project, I endeavour to discuss the work of other researchers (Farahani *et al.*, 2009) [3] who looked into how spending more money by states on public health in India can make people less likely to die. Their findings suggested that if the government spends 10% more on health, the chance of dying decreases by 2%. This seemed to help the most at-risk groups, such as children and elderly people the most.

Putting money into health care doesn't simply make people healthier but can also boost how many goods and services a country produces.

Some other researchers (Barik *et al*., 2017) [1] conducted a study and they looked at how health is different for people in India based on how much money they have. What they found was, places where people don't have a lot of money saw more people dying; this really shows that, in those poor areas, we need to step in and help with better health material to cut down on this strikingly large difference in who gets to live and who doesn't; this study made it extremely unmistakeable that just because a country is getting more money, doesn't mean everyone is automatically getting healthier. It's not all people get to in a literal sense enjoy the advantages.

A few more researches (Burgess *et al*., 2017) [2] looked into how the weather changing, especially getting hotter, affects how many people die in India; they found out that when the weather goes extreme, more people in the countryside who rely on farming suffer and die; this means, when making plans for growing the economy, it is, clearly, apparent to us that they must think about keeping the environment healthy to really help people live better, and for the long run.

These studies essentially show us that, for India to do better economically, it's very necessary to spend more on public health and think carefully regarding environmental issues, to tackle death rates; they highlight how health and the economy are connected, meaning when you put money into healthcare, it's likely to, almost certainly, result in a major boost for economic stability and growth.

2. Methodology

The methodology used in this research paper include statistical technique like Chi-square test. Other researcher (Yadav, 2022) [6] looked at how death rates affect India's economy from 2011 to 2019; the main point of this entire piece is that they used special mathematical methods, such as finding out if things match and guessing what will happen, to figure it out; they wanted to see if changes in how many people passed away would change India's GDP, which is characterized by the money the country earns.

2.1 Data Collection

I got the data for my project from World Bank and other research papers; they have many numbers regarding how much money countries make and how many people die, which is extremely useful for what I was looking at; to tell the truth, I consider these places amazing because they helped me a lot with my work. I was trying to see if there's a link between how rich a location is and how many people die there every year. I just zoomed in on the numbers for each year in the time frame I picked, trying to make sense of the patterns.

2.2 Statistical Technique

2.2.1 Chi-square Test: The Chi-square test is used to find out whether two variables are related to each other or not. If we break it down, we use " O_i"(observed frequency) to label what we actually see happen in our experiments, and "E_i"(expected frequency) to note what we thought was going to happen, according to theories; the upshot of this entire piece is, clearly, that the Chi-square test has an enormous role in helping us grasp the gap between prediction and reality in scientific studies.

3. Analysis

The statistics give broad description of impact of death rates and GDP in India from 2011 to 2019 (Yadav, 2022) (6), highlighting some statistics, indicators, and patterns observed in this timespan.

Table 1: Death rate in India gradually fallen in recent selected time, according to following annual rates per 1,000 persons:

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Death Rate (per 1,000)	7.39	7.31	7.25	7.21	7.19	7.20	7.21	7.23	7.27

The details above indicate a slight general decline of death rates, stabilizing across 7.24 to 7.27 in the later years.

Table 2: GDP increasing rates in India during same years are shown below:

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
GDP Growth Rate (%)	5.24	5.46	6.39	7.41	8.00	8.26	6.80	6.53	4.04

Above data reflects fluctuations over GDP development, peaking between 8.26% during 2016 but decreasing by 4.04% in 2019, indicating financial burden.

3.1 Chi-square test

This test is based on χ^2 distribution. With the help of the data of death rates and GDP Growth Rates given by other researcher (Yadav, 2022) (6), we use this test to find our own results. We classify death rates into following groups:

Low Death Rate (≤ 7.20 deaths per 1,000)

High Death Rate (> 7.20 deaths per 1,000)

Also, we classify GDP Growth rates into following groups:

Low GDP Growth (≤ 5.50%)

Moderate GDP Growth (5.50% - 7.50%)

High GDP Growth (> 7.50%)

There is no class of year where low death rates with low and moderate GDP Growth rates occur together, also high death rates and high GDP Growth rates have not occurred simultaneously. There are 2 years (2015,2016) in which low death rates and high GDP Growth rates happened simultaneously. Also, there are 3 years (2011,2012,2019) with high death rates and low GDP Growth rates and 4 years (2013,2014,2017,2018) with high death rates and moderate GDP Growth rates happened simultaneously. We place these observations in the following table of observed frequencies (O_i).

Table 3: Of observed frequencies (O_i):

Death Rates (per 1000)	Low GDP Growth (≤5.50%)	Moderate GDP Growth (5.50% -7.50%)	High GDP Growth (>7.50%)	Total
Low Death Rate (≤ 7.20 deaths)	0	0	2	2
High Death Rate (> 7.20 deaths)	3	4	0	7
Total	3	4	2	9

Now we calculate the expected frequencies for each cell, the formula to calculate expected frequencies (E_i) is given by,

$$E_i = \frac{(row\ tatal)(column\ total)}{grand\ total}$$

- Expected frequency for Low Death Rate and Low GDP Growth: 0.66
- Expected frequency for Low Death Rate and Moderate GDP Growth: 0.88

- Expected frequency for Low Death Rate and High GDP Growth: 0.44
- Expected frequency for High Death Rate and Low GDP Growth: 2.33
- Expected frequency for High Death Rate and Moderate GDP Growth: 3.11
- Expected frequency for High Death Rate and High GDP Growth: 1.55
- Now we calculate the Chi-square (χ^2) value for each cell by the formula,

$$\chi 2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

- For Low Death Rate and Low GDP Growth: 0.66
- For Low Death Rate and Moderate GDP Growth: 0.88
- For Low Death Rate and High GDP Growth: 5.53
- For High Death Rate and Low GDP Growth: 0.19
- For High Death Rate and Moderate GDP Growth: 0.25
- For High Death Rate and High GDP Growth: 1.55

Now the sum of all Chi-square (χ^2) values is, χ^2 = 0.66+0.88+5.53+0.19+0.25+1.55 = 9.06
Also, we have to calculate degree of freedom (d.f.) by,
d.f. = (number of rows -1) (number of column-1) = (2-1) (3-1) = 2
The critical Chi-square value for d.f.= 2 at 0.05 significance level by Chi-square distribution table is 5.991.
The calculated Chi-square value (9.06) is greater than critical Chi-square value (5.991), so the null hypothesis is rejected. By accepting the alternative hypothesis, it means that there is a significant relationship between death rates and GDP growth rates in India during the time period of 2011 to 2019.

4. Results and Discussions

While we were trying to figure things out, the Chi-square test showed us that how often people die is connected with whether India's money grows or shrinks during the time we looked at. This gives us a hint that factors such as healthcare improvements and reduced mortality rates could somehow play a part in the economy picking up or slowing down--but if we really want to understand what's going on between these two, we'd need to delve deeper and learn more.
If we understand certain numbers from the chi-square test, showing some significant changes, it means that how many people are passing away is somehow connected to how good or bad the economy is in India at the moment. With these results, we might say that if we focus on making people's health better intentionally, it could actually make the economy stronger. And you may, thus, possibly come up with a direct conclusion that trying to fix health issues is not only good for living more years, but it's also an intelligent and informed move for making more money as a country.
Now, there are several things we could look at adding to assist. To begin with, seeing how much money a country spends on health could be a major issue. Then there's looking into whether people can actually get to a doctor or nurse when they need to, which means counting up hospitals or healthcare workers. Finally, we ought to think about the surroundings, for instance, if a lot of people are living in poverty or in strikingly large cities. All of these could greatly help us learn things more clearly and make our model a lot sharper.
When other researchers (Yadav, 2022) [6] looked into how death rates and India's money growth from 2011 to 2019 are connected, the findings they discovered were very important because they showed how the number of people dying affects the economy. This part discusses the main things they found out by seeing if data matched up and using math models, including why all the aforementioned matters for the large picture of the economy. To be honest, I consider this part really great, owing to it delves into how big a problem the relationship is between people dying and how much money a country is making. As the economy gets better, with math measure known as the Pearson correlation coefficient hovering around -0.73, this negative correlation shows that both variables are opposite to each other, it seems like not as many people pass away if more the country earn money. This shows the idea that when the amount of money increases in a place such as India, people appear to be healthier. There can possibly be happiness in understanding the difficult parts of that making more money could mean people live longer and better lives.

5. Conclusion

The Chi-square test provides us that there is a significant relationship between death rates and Indian economy. Low death rates lead to better economy by providing more manpower, workforce productivity and low medical costs. The analysis we conducted didn't use a large amount of data, only nine years of data, which might not be enough to fully trust what we found. Later on, researchers could try using more advanced ways of working with numbers, like looking at data over time, to determine if there's a real cause-and-effect relationship between death rates and economic growth. To wrap it up, you may be a little doubtful that how many people die has such a major effect in relation to India's financial situation. But, if India works on making people healthier, and fewer people die because of good health policies and putting money into health initiatives, not only does everyone become healthier but India has more money, too. It's focused on the mix of growing India's economy and making fully sure people are healthy showing how important it is to focus on both money and health if we want to keep getting better and better.

6. References

1. Barik D, Desai S, Vanneman R. Economic status and adult mortality in India: Is the relationship sensitive to choice of indicators? World Development [Internet]. 2017 Nov 22;103:176–187. Available from: https://doi.org/10.1016/j.worlddev.2017.10.018
2. Burgess R, Deschenes O, Donaldson D, Greenstone M. Weather, climate change and death in India [Internet]. 2017. Available from: https://www.lse.ac.uk/economics/Assets/Documents/personal-pages/robin-burgess/weather-climate-change-and-death.pdf
3. Farahani M, Subramanian SV, Canning D. Effects of state-level public spending on health on the mortality probability in India. Health Economics [Internet]. 2009 Nov 20;19(11):1361–1376. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC309558/
4. Kothari CR. Research methodology: Methods and Techniques. New Age International; c2004.
5. Kumar R. Mortality statistics in India. Indian Journal of Community Medicine [Internet]. 2022 Oct 1;47(4):476–478. Available from: https://doi.org/10.4103/ijcm.ijcm_614_22
6. Yadav N. India's Gdp and Death Rate: An Empirical Study of Indian Economy [Internet]. EPRA Journals. 2022:37-39. Available from: https://eprajournals.com/IJHS/article/6932